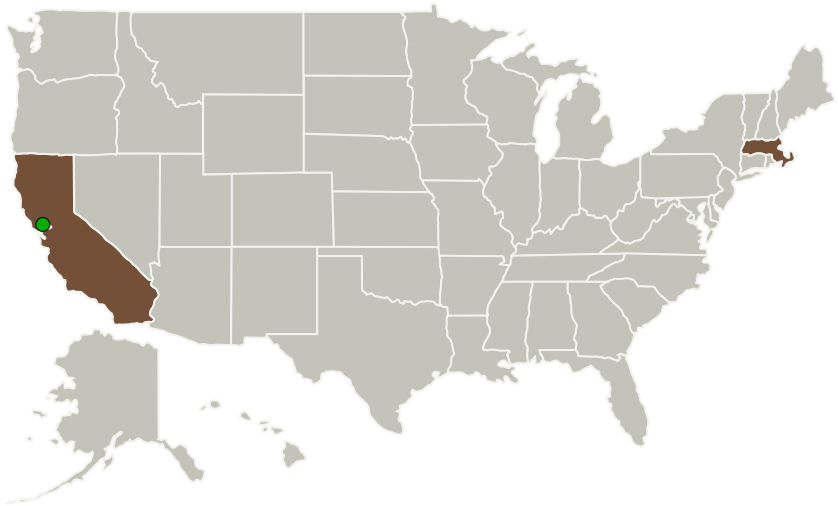
Multi-Robot Planetary Exploration Architectures, Phase II

Completed Technology Project (2010 - 2012)

Project Introduction

Space policy direction is shifting, particularly with respect to human goals. Given the uncertainty of future missions to the moon, Mars, and other bodies, a tool that allows for informed analysis of the option space is particularly relevant. Aurora Flight Sciences and MIT propose to further develop the Multi-Robot Planetary Exploration Architecture (MRPEA) methodology, a suite of software tools and analysis algorithms developed to provide decision aides to architecture planners of planetary surface exploration missions. MRPEA provides 1. A logical and graphical representation of the system space (e.g. interrelated decision variables with constraints), 2. Structural reasoning for rapid exploration of architectural spaces, 3. Simulation, and 4. Results viewing for a set of feasible architectures. Given the robots available or predicted to be available, the expected duration, and the mission goals, our methodology provides analysis results such as knowledge benefit-vs.-mass Pareto front graphs, to allow the designers to provide the best possible architecture for the planned mission or missions. The MRPEA analysis methodology primarily addresses the planning requirements of planetary surface missions, providing useful analyses of the many elements of the architectural decision space; in addition, the principles and techniques developed to analyze and select multi-robot architectures on planetary surfaces can also be applied to future fractional satellite systems, an area of increasing interest.

Primary U.S. Work Locations and Key Partners



Multi-Robot Planetary Exploration Architectures, Phase II

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

Multi-Robot Planetary Exploration Architectures, Phase II

Completed Technology Project (2010 - 2012)

Organizations Performing Work	Role	Type	Location
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Massachusetts Institute of Technology(MIT)	Supporting Organization	Academia	Cambridge, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

August 2010: Project Start

December 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139258)*

Project Management

Program Director:

Jason L Kessler

Program Manager:

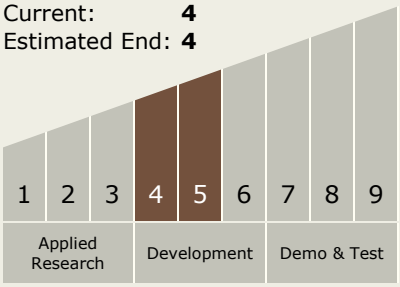
Carlos Torrez

Principal Investigator:

Jessica Duda

Technology Maturity (TRL)

Start: **5**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.6 Collaborative Mobility

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System